DISPLAY DEVICE FOR WATCH

BACKGROUND OF THE INVENTION

The present invention relates to a display device for a watch of the type comprising a movement provided with a frame and a display member that is mobile in rotation about an axis.

In such watches, the display generally occurs by means of hands mounted on a mobile of the movement, with one hand per function displayed. As a result, for watches comprising numerous functions, there is a large number of hands and this tends to overload the dial. It is an object of the present invention to simplify the display while indicating at least two pieces of information with the same member.

SUMMARY OF THE INVENTION

According to the invention, the display device includes:

- a display mobile pivotably mounted on the frame about said axis and arranged for carrying said member,
- first and second information wheels, each of whose angular position is a function of the state of the information with which it is associated,
- first and second connecting members for connecting respectively the first and second information wheel to the display mobile and positioning it such that said display member occupies a position corresponding to the state of said function, and
- a manual control member cooperating with the connecting members so that either one or the other forms the connection between the information wheel with which it is associated and the display mobile.

Thus, via the control member, the user can control the display of one piece of information or the other, one or other of the connecting members kinematically connecting one of the information wheels to the display mobile, such that the position of the display mobile corresponds to the angular position of the information wheel concerned.

Among the solutions that can be envisaged, it is advantageous for the first information wheel to be coaxial with the display mobile and for the first connecting member to comprise a cam and a hammer provided with an elastic member for holding the

hammer pressed against the cam, one being mounted on the display mobile, the other on the first information wheel. Consequently, while the control member is not being activated, the display mobile is driven in rotation in synchronism with the first information wheel.

Other advantages and features of the invention will appear from the following description, given with reference to the annexed drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

- Figure 1 shows a chronograph type watch fitted with a display device according to the invention;
- Figure 2 is a logic operating diagram of the movement according to the invention;
- Figure 3 is a cross-sectional view of a movement fitted with a display device according to a first embodiment of the invention;
- Figures 4a to 4d show the dial side of the movement of Figure 3, in different states corresponding to the steps defined in the diagram of Figure 2, and
- Figure 5 illustrates the back cover side of the movement of Figure 3, when the chronograph function is locked.
- Figures 6 and 7 show a part of the watch movement fitted with a display device according to a second embodiment of the invention, comprising only one hand displaying either the hour or the minute, seen in cross-section in Figure 6 and in plan view in Figure 7.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The watch shown in Figure 1 is of the chronograph type. It comprises, in a conventional manner, a case 10 acting as housing for a movement, which carries a dial 12, a current time hour hand 14, a current time and measured time minute hand 16 and measured time second hand 20.

The current time display is corrected by means of a time setting crown 22, connected to members of the movement by a time setting stem that is not visible in the drawing.

The timing functions are performed by three push-buttons 24, 26 and 28 respectively arranged at two o'clock, four o'clock and eight o'clock. Push-button 24 controls the starting and stopping of a measured time measurement, whereas push-button 26 resets hands 16 and 20 when a measured time measurement has been interrupted. Finally, push-button 28 is for making the chronograph mechanism pass from a first state, in which it is locked, into a second state in which it is unlocked.

When the chronograph mechanism is locked, hand 16 displays the minutes of the current time, whereas, when it is unlocked, it indicates the measured time. In the locked state, push-buttons 24 and 26 are inactive.

This mechanism forms part of a movement which comprises, in a conventional manner that is not visible in the drawing, an energy source, such as a barrel, a time base such as a sprung balance, a going train, of which only one mobile 29 is visible in Figure 4a, and an escapement connecting the going train to the balance in order to maintain the latter, as well as time setting and chronograph mechanisms. The various components of the movement are disposed on a frame 30, formed of a plate and bridges, which assures the relative positioning of the various mobile parts.

Figure 2 illustrates the effect of the various push-buttons depending upon the states of the chronograph mechanism, which are identified by a capital letter surrounded by a circle. In this Figure, an application of pressure onto push-buttons 24, 26 and 28, respectively corresponds to the indications P1, P2 and P3.

In the initial state, identified by **A** and corresponding to the situation illustrated by Figure 4a and 4b, the chronograph mechanism is locked. The chronograph second hand 20 is at midday and minute hand 16 displays the current time, push-buttons 24 and 26 being inactive.

An application of pressure P3 causes the chronograph mechanism to unlock. As a result, minute hand 16 is aligned at twelve o'clock, thus being superposed onto the measured time second hand 20. This state, shown in Figure 4c, is identified by the letter **B**. Minute hand 16 thus displays the measured time minutes, equal to zero at the start of the measurement.

In this state, push-buttons 24 (P1) and 28 (P3) are active. An application of pressure P1 has the effect of starting the counting of a measured time, the measured time second hand 20 starting to rotate and, more slowly, the minute hand 16. This state, shown in Figure 4d and identified by the letter **C**, brings the display to the situation illustrated in Figure 1.

In state **B**, an application of pressure P3 returns the chronograph mechanism to its initial state **A**.

In state **C**, only push-button 24 is active. An application of pressure P1 has the effect of stopping counting of the measured time. Hands 16 and 20 thus stop in the position corresponding to the measured time, which corresponds to state **D**, which only differs from state **B** in that the hands are not at zero.

Another application of pressure P1 then has the effect of restarting counting, the mechanism thus returning to state **C**, whereas an application of pressure P2 returns hands 16 and 20 to midday, which corresponds to state **B**.

In Figures 4 and 5 and in order to avoid overloading the drawings, the springs have only been shown schematically, by means of an arrow showing the force that they generate, associated with a reference Fi, "i" being equal to the reference of the part on which the spring is acting. They are essentially visible in Figure 4b.

More precisely, Figures 4a and 4b show the mechanism in its rest position, corresponding to state **A**, and Figures 4c and 4d in positions corresponding respectively to states **B** and **C** of Figure 2. Among Figures 4a to 4d, which show the dial side of the movement, some parts have been removed or partially torn away from these Figures, in order for the subjacent parts to be seen more clearly.

In the description relating to the movement described with reference to Figures 3 to 5, the terms "wheel" or "mobile" are used to differentiate between the components of the chronograph train and going train respectively.

The movement described hereinafter with reference to Figures 3 to 5 comprises, in a conventional manner that is not visible in the drawing, an energy source such as a barrel, a time base such as a sprung balance, a going train of which only one mobile

29 is visible in Figures 3 and 4, and an escapement connecting the going train to the balance in order to maintain the latter, as well as time setting and chronograph mechanisms. The various components of the movement are disposed on a frame 30, formed of a plate and bridges, which assures the relative positioning of the various mobile parts of the movement.

Figure 3 shows the central part of the movement, seen in cross-section along the line III-III of Figure 4a, with an axis A-A corresponding to the axis about which hands 14, 16 and 20 pivot. Frame 30 carries, rigidly secured to its dial side face, a tube 32 comprising a seat 32a secured to frame 30 and two cylindrical portions 32b and 32c, whose axis merges with axis A-A, and arranged one after the other, connected by a shoulder 32d and designed to act as a fixed arbour for the pivoting of the mobiles and wheels, as will be explained hereinafter.

A current time minute mobile 34 is pivotably mounted on tube 32. It is provided with a pipe 34a engaged on cylindrical portion 32b of tube 32 and a plate 34b including a toothing 34c at its periphery. Pipe 34a, plate 34b and toothing 34c are made in a single piece.

Mobile 34 meshes permanently, via its toothing 34c, with mobile 29 of the going train, in a gear ratio selected such that it completes one revolution per hour of current time.

Plate 34b is provided with:

- a cut out part 34d in the form of an annular portion covering an angle of approximately 50°, the function of which will be specified hereinafter,
- a stud 34e, on which a connecting hammer is pivotably mounted, and
- a spring tending to return hammer 36 to the centre and schematically represented by arrow F36 (Figure 4b).

A minute hand wheel 38 is arranged to be free in rotation on cylindrical portion 32c of tube 32. This wheel 38 is only visible, in plan, in Figure 4c. It comprises a plate 38a provided, at its periphery, with a toothing 38b, and a pipe 38c engaged on tube 32 and extending upwards sufficiently for its free end to be released and to allow minute hand 16 to be secured. The latter displays both the current time and the measured time, as will be explained hereinafter. Pipe 38c extends underneath plate 38a. A cam 38d, generally called a heart-piece, and more particularly visible in plan in Figures 4a, 4b

and 4d, is secured by being driven in or welded thereto. Its lower face abuts against shoulder 32d. This cam 38d is arranged such that it can cooperate with hammer 36, as will be explained hereinafter.

The movement comprises an isolating device whose components' reference starts with 39 and which includes an isolation mobile 391 mounted on pipe 34a, a lever 392, a retaining wheel 393 pivotably mounted on lever 392, an isolation lever 394 and a pawl or click 395 mounted on lever 394 (Figure 4a).

Mobile 391 comprises two superposed plates 391a and 391b, rigidly connected to each other and provided at their periphery with toothings respectively referenced 391c and 391d, and a pin 391e secured in plate 391a (Figure 3). This lower plate is provided with wolf teeth, clearly visible in Figure 4a, whereas toothing 391d, of upper plate 391b comprises the same number of teeth and has the same profile and same diameter as toothing 34c. Pin 391e is engaged in cut out part 34d and extends as far as hammer 36.

Retaining lever 392 is mounted on frame 30, pivoting in its median part. It carries, at one of its ends, wheel 393 which can rotate on a stud 392a driven into lever 392, whereas the other end forms a nose 393b which, as will be explained hereinafter is for controlling the movement of lever 392. A spring F392 tends to apply nose 392b against a support surface.

As shown schematically in Figure 3, wheel 393 is formed of two plates 393a and 393b, connected to each other by a click 393c and respectively capable of being meshed with toothings 34c and 391d. Click 393c is arranged such that, when mobile 34 is rotating in the clockwise direction, the click is locked, such that plate 393b drives mobile 391 in rotation. If, conversely, it is the latter that is being rotated in the clockwise direction, only plate 393b is driven, click 393c performing its uncoupling function.

Lever 394 comprises (Figure 4a):

- a body 394a pivotably mounted on frame 30, by the engagement of a hole 394b made at one of the ends of body 394a of the lever in an unreferenced stud, secured to frame 30,
- a nose 394c, located in proximity to hole 394b for controlling the movement of lever 394,

- a stud 394d driven into the body at the opposite end to that provided with hole 394b, on which pawl 395 pivots, and
- a pin 394e, forming a stop member and limiting the movement of pawl 395.

Lever 394 is positioned by nose 394c abutting against a support surface, via the action of a spring F394. A spring F395 tends to hold pawl 395 abutting against pin 394e.

Isolation mobile 391 can be moved by an angle of approximately 45° with respect to mobile 34, by the engagement of pawl 395 in toothing 391c. During this movement, pin 391e, moving freely in cut out part 34d, raises hammer 36 whose free end is brought back towards the exterior.

When the chronograph mechanism is locked, by means that will be explained hereinafter, hammer 36, positioned by spring F36, which tends to apply it against cam 38d, performs the function of connecting member between mobile 34 and wheel 38, which are thus secured to each other in rotation. This thus means that minute hand 16, carried by pipe 38c of wheel 38, displays the minutes of the current time.

In order to count the measured time, the movement shown in the drawing comprises a chronograph second wheel 40, pivotably mounted in tube 32, visible in Figure 5 and partially in Figure 3, and a sliding gear 42 (Figures 3, 4c and 5). Wheel 40 comprises an arbour 40a pivotably mounted in tube 32 and in frame 30, a plate 40b driven onto arbour 40a and provided with a toothing, a cam 40c, also driven onto arbour 40a, and a drive finger 41.

The chronograph mechanism further includes a coupling mechanism, not visible in the drawing, provided with a wheel which, when the chronograph mechanism is in state **C**, kinematically connects wheel 40 to the going train, such that it is driven in rotation, at a rate of one revolution per minute. Such a coupling mechanism is well known to those skilled in the art.

Slide gear 42 comprises an arbour 42a (Figure 3) rotatably mounted in a jewel 43, with an olive jewel-hole, driven onto a bridge of frame 30 and on a lever 44, itself pivoting on frame 30 and which will be described in more detail hereinafter. It further comprises two wheels 42b and 42c, respectively for cooperating with finger 41 and wheel 38. Depending upon the position that lever 44 occupies, wheel 42b is either in

the space swept by finger 41 or not. Moreover, wheel 42c is permanently meshed with toothing 38b. Lever 44 tends to move in the direction of the centre of the movement via the effect of a spring F44 (Figure 5).

When the chronograph mechanism is in one of states **B**, **C** or **D**, hammer 36 is raised by pin 391e, such that it is no longer abutting against cam 38d. Mobile 34 and wheel 38 are thus no longer secured in rotation. Moreover, when the mechanism is in state **C**, arbour 42a is arranged parallel to the axis A-A and its wheel 42b can be driven in rotation by finger 41, by one step for each revolution of wheel 40. In other words, slide gear 42 performs the function of a connecting member between measured time second wheel 40 and wheel 38, so that the latter displays the measured time minutes when the mechanism is in state **C** or **D**.

The connecting members formed by hammer 36, spring F36 and cam 38d on the one hand, and slide gear 42 on the other hand, perform together the function of switching means.

Since current time minute mobile 34 is permanently rotating, driven by the going train, isolation mobile 391 has to rotate with it, otherwise hammer 36 could not be controlled. Therefore, retaining wheel 393 is made to mesh with toothings 34c of mobile 34 and 391d of isolation mobile 391, the two plates 393a and 393b being secured to each other in rotation by click 393c.

In order to perform the functions as defined with reference to Figure 2, the chronograph mechanism shown in Figures 4 and 5 comprises, in addition to the gear trains and the isolation device described hereinbefore:

- a switch for enabling or disabling the timing function, and whose constituent parts are defined by references starting with 46,

- a control device, controlling the starting and stopping of a measurement, and whose constituent parts are defined by references starting with 48, and

- a reset device, for reinitialising the measured time counters, and whose constituent parts are defined by references starting with 50.

It should be noted that these devices interact and that some parts are arbitrarily defined as forming part of one device rather than another.

Switch 46 is controlled by push-button 28. It allows minute hand 16 to be returned to zero, and push-button 24 to be made active. It comprises, for this purpose (Figure 4a):

- a switching member 461, comprising:
  - a bird-shaped body 461a, with a head 461b provided with a hole 461c in which there is engaged a stem passing right through frame 30 and carrying a finger 461d visible in Figure 5, a beak 461e, two wings 461f and 461g, wing 461g being provided with a pin 461h, and a tail 461j, the head being disposed on the centre side of the movement and tail 461j at the periphery, in proximity to 7 o'clock,
  - a lever 461k pivotably mounted on tail 461j and extending over the periphery of the movement from 7 to 9 o'clock, provided with a pin 461m disposed so that it is or is not located on the path travelled by push-button 28, when it is activated depending upon the position occupied by lever 461k, and a stop member 461n arranged at its free end,
  - a pawl 461p pivotably mounted on lever 461k and limited in its movement by stop member 461n,

- a switching cam, for example a column wheel 462, shown schematically, controlled in rotation by pawl 461p, rotating on frame 30 at 462a, and cooperating with noses 392b of lever 392 and 394c of lever 394,

- an interlocking lever 464, comprising a body of elongated shape 464a, pivotably mounted on frame 30 in its median part, and one of whose ends is provided with a nose 464b arranged for cooperating with the columns of wheel 462, whereas the other end comprises a first oblong hole 464c in which a stud 465 is mounted so as to slide, for cooperating with control device 48, and a second oblong hole 464d, in which a pin 466 with a head is housed, itself secured to frame 30, for positioning the lever in the plane of the movement.

The constituent parts of switch 46 are positioned by springs shown schematically in Figure 4b and more particularly:

- body 461a by spring F461a,
- lever 461k by spring F461k which tends to return it when pressure has been applied to push-button 28,
- pawl 461p by spring F461p which holds it pressed against pin 461n,
- body 464a by spring F464a, which tends to apply nose 464b against wheel 462, and
- stud 465 by spring F465, which tends to press it on the external side of oblong hole 464c.

Control device 48 is more particularly visible in Figure 5. It comprises:

- a control lever 481 comprising:
  - a body 481a disposed at the periphery of the movement from 2 to 7 o'clock, which pivots at 481b on frame 30 slightly below 4 o'clock, and which is provided, at one of its ends, with a bent portion 481c extending into the thickness of stud 465, and
  - a pawl 481d, pivotably mounted on the other end of body 481a, whose function will be specified hereinafter,

- a cam 482, for example of the column wheel type, driven by pawl 481d, which controls the coupling mechanism of the chronograph, not shown in the drawing, and positions switching member 461 via its finger 461d.

The constituent parts of control device 48 are positioned by springs and more particularly:

- body 481a, by spring F481a which tends to return it when pressure has been applied to push-button 24, and
- pawl 481d, by spring F481d, which applies it against cam 482.

Reset device 50 comprises :

- a reset lever 501 (Figure 4a) arranged and pivotably mounted at the periphery of frame 30 and extending from 4 o'clock to 6 o'clock, provided at its end in proximity to 4 o'clock with a pin 501a for cooperating with push-button 26, and at its other end with a groove 501b for cooperating with pin 461h,

- a hammer 502 for resetting the minutes to zero arranged in proximity to column wheel 462 and extending as far as the central part of the movement to cooperate with cam 38d via a support surface 502a provided with:

  - a nose 502b which cooperates with the columns of wheel 462, and

  - a pin 502c for cooperating with wing 461f, and

- a hammer 503 for resetting the seconds to zero (Figure 5) pivotably mounted on the opposite face of frame 30 in proximity to cam 482, provided with:

  - a nose 503a cooperating with cam 482,
  - a retaining finger 503b cooperating with lever 44 via a pin 44a comprised in the latter, and
  - a support surface 503c for returning the second hand to zero by abutting against cam 40c.

The constituent parts of reset device 50 are positioned by springs and more particularly:

- lever 501 by spring F501, which tends to return it after pressure has been applied on push-button 26,
- hammer 502 by spring F502, which tends to apply support surface 502a against cam 38d, and
- hammer 503 by spring F503, which tends to apply it against cam 40c.

The movement further comprises a current time hour mobile 52, pivotably mounted on pipe 38c of minute hand wheel 38. Mobile 52 carries current time hour hand 14. It is

kinematically connected to mobile 34 by a motion work, which divides the movement by a factor of 12. This motion work has not been shown to avoid overloading the drawing.

When the chronograph mechanism is at rest, namely in state **A** defined with reference to Figure 2, its constituent parts are in the position shown in Figures 4a, 4b and 5. More particularly, nose 392b of retaining lever 392 is between two columns of column wheel 462 via the effect of spring F392, such that retaining wheel 393 is not meshed with toothings 34c and 391d. Nose 394c of lever 394 is also between two columns via the effect of spring F394, so that pawl 395 is withdrawn from toothing 391c. Thus, hammer 36, via the action of spring F36 is abutting against cam 38d. Wheel 38 of the minute hand is rotating, consequently, in synchronism with current time minute mobile 34.

The interlocking lever 464 is abutting, via its nose 464b and via the effect of spring F464a, against a column of wheel 462, such that stud 465 is not inserted between push-button 24 and bent portion 481c, which disables push-button 24. Moreover, an action on push-button 26 causes lever 501 to pivot, but without it acting on any of the other parts.

An application of pressure on push-button 28 activates pin 461m, which drives with it lever 461k, which causes the chronograph mechanism to switch. More precisely, the tipping of lever 461k drives pawl 461p, which rotates column wheel 462 and generates the following movements, which occur practically simultaneously or in the following order:

- nose 392b of retaining lever 393 is raised by a column, which causes wheel 393 to mesh with toothings 34c and 391d;

- nose 394c of lever 394 is raised, such that pawl 395 meshes with toothing 391c, driving in rotation, clockwise, mobile 391 and the single plate 393b, plate 393a, meshed with mobile 34, being disconnected, because of click 393c;

- during the relative movement of mobile 391 with reference to mobile 34, pin 391e raises hammer 36, such that cam 38d of wheel 38 is no longer maintained in phase with mobile 34;

- nose 502b of hammer 502 falls, via the effect of spring F502, between two columns of wheel 462, support surface 502a cooperating with cam 38d such that wheel 38, which carries hand 16, brings the latter to midday, and

- nose 464b of interlocking lever 464 falls between two columns of wheel 462 via the effect of spring F464a, bringing stud 465 between push-button 24 and bent portion 481c.

The mechanism is then in state **B** defined in Figure 2 and shown in Figure 4c. The connecting member formed by hammer 36 and cam 38d then no longer provides the connection between wheel 38 and mobile 34. Switch 46 thus plays the part of control member, and deactivates the connecting member. In this state, push-buttons 24 and 28 are operational. If push-button 28 is pressed again, lever 461k, tips and drives pawl 461p. This causes column wheel 462 to rotate, which generates the following movements, which occur practically simultaneously or in the following order:

- nose 392b of retaining lever 392 falls between two columns of wheel 462 via the effect of spring F392, wheel 393 thus being released from toothings 34c and 391d;

- nose 502b is raised by a column, such that hammer 502 releases cam 38d;

- nose 394c falls back between two columns and lever 394 returns to the position shown in Figure 4a via the effect of spring F394;

- via the effect of spring F36, hammer 36 tips and abuts against pin 391e, which causes isolation mobile 391 to rotate, then against cam 38d which drives wheel 38 until hand 16 again displays the minutes of the current time; and

- nose 464b of interlocking lever 464 is raised by a column of wheel 462 such that stud 465 leaves the space comprised between bent portion 481c and push-button 24.

The mechanism has thus returned to state **A** shown in Figure 4a.

From state **B**, shown in Figure 4c, it is also possible to activate push-button 24, which has the effect of starting a measured time measurement. More specifically, push-button 24 abuts against stud 465, which slides into oblong hole 464c and, applied against bent portion 481c, causes body 481a of lever 481 to pivot. Its pawl 481d, more particularly visible in Figure 5, causes cam 482 to rotate through one step. This movement of cam 482 generates the movements described hereinafter, which occur practically simultaneously or in the following order:

- hammer 503, visible in Figure 5, is raised via its nose 503a, such that support surface 503c is released from cam 40c;

- the chronograph coupling mechanism causes the coupling wheel to mesh both with the going train and the chronograph second wheel 40, so that the latter is driven in rotation and, with it, chronograph second hand 20;

- retaining finger 503b releases pin 44a from lever 44, such that spring F44 causes lever 44 to pivot, wheel 42b being then positioned such that it is in the space swept by finger 41, which can then rotate slide gear 42 and, via the latter, wheel 38 of the minute hand, at a rate of one step per minute, and

- finger 461d is raised by a column of cam 482, which causes body 461a (Figure 4b) and lever 461k of switching member 461 to tip. Consequently, pin 461m is shifted with respect to push-button 28, thus disabling the latter. Moreover, wing 461f raises hammer 502 via its pin 502c, thus allowing minute hand wheel 38 to rotate.

Moreover, the pivoting of body 461a brings its pin 461h into groove 501b of reset lever 501. During this operation, the connecting member formed by slide gear 42, controlled by control device 48 via hammer 503, passes from the deactivated state to the activated state.

The mechanism is then in the position shown in Figure 4d, which corresponds to state **C** of Figure 2. In this state, only push-button 24 is active. In fact, pin 461m is shifted with respect to push-button 28, which disables the latter. Moreover, body 461a, whose position is defined by finger 461d abutting against a column of cam 482, remains in this position, even if groove 501b releases pin 461h. In other words, an application of pressure on push-button 26 has no effect.

An application of pressure on push-button 24 causes it to abut against stud 465 which slides into oblong hole 464c and, applied against bent portion 481c, causes lever 481 to pivot. Its pawl 481d (Figure 5) causes cam 482 to rotate through another step. This movement of cam 482 generates the movements described hereinafter, which occur practically simultaneously, or in the following order:

- the chronograph coupling mechanism is moved, such that chronograph second wheel 40 is no longer connected to the going train, which means that it stops;

- finger 461d passes from abutting against a column of cam 482 to a position in which it is between two columns, without, however, body 461a and finger 461d pivoting, since body 461a is retained by pin 461h engaged in groove 501b of lever 501; and

- nose 502a of hammer 502 is between two columns of wheel 462, but it does not change position, because of pin 502c which is abutting against wing 461f of body 461a.

Hammer 503 is retained by similar means to those retaining hammer 502, but they have not been shown in order to avoid overloading the drawing. The chronograph mechanism is then in state **D** of the logic diagram of Figure 2. This state, which is not shown in the drawing, allows action on push-buttons 24 and 26. An application of pressure on push-button 24 starts the time count, the mechanism returning to state **C** via another rotation of cam 482. Thus, the chronograph coupling mechanism is coupled again, whereas nose 503a of the hammer and finger 461d are abutting against a column of cam 482.

When the mechanism is in state **D**, an application of pressure on push-button 26 drives lever 501 which, by pivoting, releases pin 461h. Since finger 461d is between two columns of cam 482, nothing is holding it any longer, such that spring F461a returns switching member 461 to the position shown in Figure 4b. Moreover, hammer 502 is no longer held by wing 461f, such that its spring F502 causes it to tip and abut against cam 38d, which has the effect of resetting minute hand 16 to zero.

A similar process is applied to hammer 503, such that cam 40c is also subjected to a force that returns measured time second hand 20 to midday. The chronograph

mechanism is then again in state **B** defined hereinbefore, such that it is possible to press on push-button 28, to return the mechanism to state **A**, where push-buttons 24 and 26 are disabled and where minute hand 16 displays the minutes of the current time. It is also possible to press on push-button 24 in order to start a new measurement, the mechanism then being in state **C**.

The display device shown in Figures 6 and 7 indicates either the minute or the hour. It is shown in the minute display position in Figure 7a, and in the hour display position in Figure 7b. It is designed to be fitted to a watch movement comprising a frame 110, which carries an energy source, in this case a barrel 112, visible in Figure 6, which drives a going train, whose first mobile is a minute wheel 114. This latter, arranged at the centre of the movement, pivots on frame 110 about an axis A-A and carries a friction mounted cannon-pinion 116 and which meshes with a motion work 118, which drives an hour wheel 120.

Cannon-pinion 116 and hour wheel 120 respectively complete one revolution in sixty minutes and in twelve hours, their angular position defining the state of the information to be displayed. They thus perform the function of information wheels. Moreover, cannon-pinion 116 and motion work wheel 118 and hour wheel 120 play the part usually taken by the motion work in conventional watch movements, the only difference being that none of these mobiles carries a hand.

The cannon-pinion comprises more specifically a tubular portion 116a, pierced right through and friction engaged on the centre wheel 114, a pinion 116b secured to portion 116a and meshing with motion work wheel 118, a wheel plate 116c, secured to portion 116a, provided with a toothing 116d and carrying a hammer 122. This latter is pivotably mounted on a stud 123 driven into plate 116c. The hammer is subjected to the action of a spring, schematically represented by an arrow F1 in Figures 7a and 7b, which tends to push hammer 122 back in the direction of axis A-A.

Cannon-pinion 116 carries, free in rotation, a display mobile 124 comprising, rigidly secured to each other, a plate 124a provided with a toothing at its periphery, a pipe 124c engaged on tubular portion 116a and a cam 124d inserted between plate 124a and plate 116c, at the same height as hammer 122. Consequently, via the effect of spring F1, hammer 122 is applied against cam 124d. As a result, display mobile 124 is driven in rotation by cannon-pinion 116, via hammer 122 and cam 124d, completing one revolution in sixty minutes. This situation is illustrated in Figure 7a.

Pipe 124c carries a hand 126, which, in the circumstances described hereinbefore, thus displays the current time minute.

Hour wheel 120 is shifted with respect to the centre of the movement. It includes a plate 120a provided with a toothing 120b at its periphery, which meshes with the pinion of motion work wheel 118. It is arranged to be free in rotation on a tube 128 driven onto frame 110. It carries a hammer 130 pivotably mounted on a stud 130a driven into plate 120a. This hammer 130 includes a head 130b and a tail 130c arranged on either side of the pivoting point, whose function will be described hereinafter. Plate 120a has an aperture 120c in the form of an annular portion and extending over an angle of approximately 90° (Figures 7a and 7b).

A control wheel 132 is mounted coaxially to hour wheel 120 about tube 128. It comprises a plate 132a inserted between wheel 120 and frame 110 and provided, at its periphery, with a toothing 132b. A pin 132c is driven into the plate, disposed such that it is engaged in aperture 120c and projects beyond the latter, extending into the thickness of hammer 130, and arranged for cooperating with tail 130c.

Plates 120a and 132a are each provided with a hole identified by the letter e. A wire spring 134 is inserted between these plates, its ends being engaged in holes 120e and 132e (Figures 7a and 7b). This spring tends to hold wheels 120 and 134 in a relative position such that pin 132c is substantially at one of the ends of aperture 120c.

The display device further includes a wheel 136 comprising, rigidly secured to each other, a plate 136a provided with a toothing 136b at its periphery, an arbour 136c rigidly secured to plate 136a and pivotably engaged in tube 128, and a cam 136d, inserted between plates 136a and 132a, at the same level as hammer 130. Wheel 136 has the same diameter and the same number of teeth as indication wheel 124 to which it is kinematically connected via an intermediate wheel 138 pivotably mounted on frame 110.

As was explained hereinbefore, hand 126, carried by indication wheel 124, displays the information defined by the angular position of minute wheel 114 when the device is in the position illustrated in Figure 7a.

If, via means that will be described hereinafter, wheel 132 is now rotated with respect to wheel 120, pin 132c moves into aperture 120c. During this movement, the pin abuts against tail 130c of hammer 130 and raises it, such that head 130c is pushed against cam 136d and exerts pressure that causes the rotation of wheel 136 until it is abutting against the most central part of cam 136d. In this position, wheel 136 occupies an angular position corresponding to that of hour wheel 120. Moreover, tail 130c is arranged such that pin 132c is held in its end position, which corresponds to a notch function.

Since intermediate wheel 138 connects wheel 136 to indication wheel 124, this latter is also driven in rotation. As wheels 124 and 136 have the same number of teeth, they rotate in the same direction and at the same speed as hour wheel 120. Cannon-pinion 116 is not involved in this movement. Hammer 122 is thus raised. In other words, the movement of wheel 132 with reference to hour wheel 120 causes the display to pass from indicating the minutes to indicating the hours.

In order to move wheel 132, the device according to the invention further comprises, a control mechanism 140 mounted so as to slide on frame 110, a rack 142 arranged in proximity, at the same level as wheel 132, and controlled by a finger 140a comprised in control mechanism 140 and a spring 144 cooperating with rack 142 to hold it, in the rest position, in the position shown in Figure 7a. A push-button that is not shown in the drawing, mounted so as to slide in the watchcase, cooperates with control mechanism 140 and pushes it in the direction of axis A-A. Finger 140a tips rack 142, which drives with it wheel 132, which controls the hour display, by the process that has been described.

As soon as the push-button is released, spring 144 returns rack 142 to its start position which, by this movement, causes wheel 132 to rotate in the opposite direction. Consequently, pin 132c no longer holds tail 130c of hammer 130. Spring 134 participates in this movement and repositions wheel 132 in a position relative to wheel 120 corresponding to that shown in Figure 7a, hand 126 thus again displaying the minutes.